



18. Does this topic impact any other disciplines? Note: This number can be skipped if answer to part 9 is "yes."

\_\_\_\_\_ Yes  No If yes, obtain signature(s). Any objections should be stated in writing and attached to this form.

\_\_\_\_\_ Support \_\_\_\_\_ Oppose  
Discipline Signature Date

\_\_\_\_\_ Support \_\_\_\_\_ Oppose  
Discipline Signature Date

19. Location (if topic not offered at main campus) Online

20. Is this course being offered on-line?  Yes \_\_\_\_\_ No

21. Is this a contract topic?  Yes \_\_\_\_\_ No

22. Enrollment Limit: 30

23. Requested Bldg/Room N/A  
Please call Extended Studies first to reserve the room.

Please note: A separate Form E-T must be submitted for each section offered.

SIGNATURES

N/A - presigned before  
1. Program/Center/Department - Director/Chair \_\_\_\_\_ Date

[Signature]  
2. College Dean (or Designee) \_\_\_\_\_ Date

The academic credentials of the instructor listed above are known to the Program/Center/Department (either regular faculty, or adjunct faculty with a curriculum vitae on file in the Program/Center/Department Office). The instructor is qualified to deliver the topic as described in part 9 (or on a previous Form T or Form E-T in the case of a topic that has already been offered).

[Signature]  
3. Dean of Extended Studies (or Designee) \_\_\_\_\_ Date 06/01/07

Completed form received in the Office of Extended Studies

[Signature]  
4. Associate Vice President for Academic Affairs - Academic Programs \_\_\_\_\_ Date 6/29/07



**James H. Kessler**  
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**Silver Spring, Maryland, 20901**  
**202-872-6165**  
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**Work Experience:**

**1989-present**

**American Chemical Society**

Develop and publish inquiry-based physical science activities for grades K-8 in print and on the web. Conduct teacher professional development workshops for teachers in grades 3-8 both in-person and online.

**1988-1989**

High school science teacher, Largo High School, Prince George's County Maryland.

Taught 9<sup>th</sup> grade Biology. Developed lessons and labs for freshman biology with an emphasis on life processes at the molecular level.

**1986-1988**

High school science teacher, Escola Graduada de Sao Paulo, Sao Paulo, Brazil.

Taught 9<sup>th</sup> grade Biology, 11<sup>th</sup> grade Physical Science, and co-taught Theory of Knowledge in the International Baccalaureate program.

**1982-1986**

Association of Trial Lawyers of America (ATLA), Washington, DC

Associate editor for the ATLA Law Reporter

Wrote articles reviewing case law and appellate decisions in the developing area of products liability law.

**Education:**

**1983-1985**

University of Maryland, College of Education, College Park, MD

BS Science Education, 1985

**1979-1982**

Boston University School of Law, Boston MA

JD, 1982

**1974-1978**

Columbia University, New York, NY

BA Philosophy, 1978



## Overview

# Chemistry Through Inquiry

## Course description

The course focuses on the National Science Education content standards for physical science and "science as inquiry" for K-4 and 5-8. As teachers do hands-on science investigations, read science background, and participate in discussion they will enhance their own science content knowledge and develop an inquiry-based approach to science teaching.

## Performance objectives

In this course, students will:

1. Develop an understanding of the National Science Education Standards for scientific inquiry and physical science for elementary and middle school students.
2. Identify and explore developmentally appropriate activities that meet the NSES goals for chemistry-related physical science.
3. Understand the elements of design of inquiry-based physical science activities and demonstrate proficiency as they analyze and conduct guided inquiry activities.
4. Develop strategies to:
  - o Motivate students to ask scientific questions they can investigate.
  - o Guide students to identify and control variables to design valid scientific investigations.
  - o Integrate abilities and understandings of scientific inquiry with physical science content.
5. Improve own understanding of fundamental chemistry concepts related to the science activities and identify appropriate level of understanding for students.
  - o Physical properties and physical change,
  - o States of matter,
  - o Density,
  - o Mixtures and solutions, and
  - o Chemical change
6. Develop a method for using science investigations as either formative or summative assessments.

## Course Outline

### Week 1: What is Inquiry?

This week we read about inquiry from the National Science Education Standards and learn how an activity can be used to generate student questions and investigations.

**Major Idea:** Inquiry content and physical science content should be integrated when teaching science.

**Week One topics include:**

- What Is Inquiry? NSES for Inquiry.
- Choosing Science Content. NSES for physical science.
- Is Seeing Believing? Substances have characteristic properties.
- Student Questions. Using student-generated questions to lead scientific investigations.
- Putting Ideas (and M&Ms) Together. Identifying and controlling variables to create a fair test.
- Speaking the Language. Solutes, solvents, and the process of dissolving.

- Literature Connection. Historical example of famous controlled experiment.
- Get Your Feet Wet with Chemistry Content. Characteristics of water at the molecular level.

## Week 2: Physical Properties and Physical Change

This week we investigate physical properties and physical change to discover the identity of an unknown solid and an unknown liquid.

**Major Idea:** Helping students to identify and control variables to design a fair test. A performance assessment can be an effective way of assessing this and other abilities and understandings of scientific inquiry.

### Week Two Topics Include:

- Chemistry Mystery Solvers. The characteristic properties of substances can be used to identify unknown substances.
- Seeing Is Perceiving. Developing tests to identify and compare characteristic properties of solids.
- Dissolving is the Solution! Solubility is a characteristic property a substance.
- There and Back Again. In a physical change the identity of the substance itself is not changed.
- Flowing Right Along. Developing tests to identify and compare characteristic properties of four household liquids.
- Combining Liquids. The household liquids combine with water in characteristic ways.
- Assessing Progress. Inquiry activities as performance assessments.
- Mixin' It Up with Solutions. Physical properties, physical change, and solubility.

## Week 3: States of Matter

This week we investigate the different states of water and explore how changes in temperature can affect them.

**Major Idea:** Developing strategies to help students design tests to investigate the effect of changes of state. Changes in state are a result of transfer of energy.

### Week Three Topics Include:

- Expanding Possibilities. Gases expand when they are warmed.
- A Gas Bubble-o-meter. Gases contract when they are cooled.
- Evaporation and Condensation. Adding heat increases the rate of evaporation.
- Concentrate on Condensation. Removing heat increases the rate of condensation.
- A Moisture Mystery. Water vapor in the air condenses when it is cooled.
- Catch Your Breath. Real-life applications of condensed water vapor.
- Frosty the Snowman. Water vapor condenses to a liquid and then freezes to ice.
- State Your Case. Heat transfer and changes of state.

## Week 4: Density

This week we explore the concept of density through the context of sink and float.

**Major Idea:** Developing a meaning of density by comparing the weight of equal volumes of different substances. Changes in mass and volume affect density.

### Week Four Topics Include:

- Floating the Concept of Density. Weight and volume determine density.
- Predicting Floaters and Sinkers. Comparing the weight of equal volumes of substances.
- Liquid Layers. Liquids have different densities and may sink or float in water.
- Temperature Tower. Hot water is less dense than cold water.

- **Changing a Liquid's Density.** An object may sink in fresh water yet float in saltwater because saltwater is more dense.
- **Whatever Floats Your Boat.** Increasing the volume of an object will decrease its density.
- **Density is Uncanny.** Life preservers work by adding volume without much mass.
- **Content Background.** Density is a combination of the mass of the particles and how tightly they are packed.

## Week 5: Combining Substances

This week we discover that solids, liquids, and gases can all form solutions. We also use the evidence of chemical change to identify an unknown.

**Major Ideas:** Developing an understanding of the definition of solution and creating a chemical testing strategy to identify an unknown substance.

### Week Five Topics Include:

- **Just the Right Mix.** Solids and liquids may or may not dissolve in water.
- **Deconstructing the M&M.** Substances break down to different extents in different solvents.
- **Gases Dissolve, Too!** Dissolved carbon dioxide gas can be removed from carbonated water.
- **The Lemon Soda Challenge.** Use understanding of dissolved gases to solve the problem of maintaining carbonation in a lemon soda.
- **Colorful Cabbage.** Substances react chemically in characteristic ways.
- **Mystery Powder Line-Up.** Characteristic results of chemical tests are used to identify an unknown.
- **More Evidence of Chemical Change.** Temperature change and formation of a precipitate can also be evidence of chemical change.
- **Reviewing Mixtures, Solutions, and Chemical Changes.** A chemical reaction involves the breaking and making of bonds.

## Culminating Project

Students describe an investigation they have conducted or observed that develops a physical science principle. They then explain how the lesson incorporates or could be modified to incorporate the 5 essential features of inquiry.

OK